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EXAMINER	
LEE, JOHN W	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/800,420	Applicant(s) KRAFT, RAYMOND H.	
	Examiner JOHN Wahnkyo LEE	**Art Unit** 2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 October 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-39* is/are pending in the application.

4a) Of the above claim(s) *8-15 and 21-28* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7,16-20 and 29-39* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

- Claims 1-7, 16-20 and 29-39 are pending; claims 1 and 16 are amended; claims 8-15 and 21-28 are canceled; claims 29-39 are added.

Response to Amendments/Arguments

1. Applicant's amendment filed 25 October 2010 has been fully considered.

2. Applicant's arguments of the rejected claims 16-20 under 35 U.S.C. § 101 have been considered. However, the rejection cannot be withdrawn. The details will be explained later under the 35 U.S.C. 101 section,

3. Claim rejection under 35 U.S.C. 112, second paragraph is withdrawn.

4. Applicant's arguments of the rejected claims 1-7 and 16-20 have been considered, but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 101

5. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

The USPTO "Subject Matter Eligibility of Computer Readable Media" (Official Gazette Notice 1351 OG 212 February 23, 2010, reads as follows:

> The United States Patent and Trademark Office (USPTO) is obliged to give claims their broadest reasonable interpretation consistent with the specification during proceedings before the USPTO. See In re Zletz, 893 F.2d 319 (Fed. Cir. 1989) (during patent examination the pending claims must be interpreted as broadly as their terms reasonably allow). The broadest reasonable interpretation of a claim drawn to a computer readable medium (also called machine readable medium and other such variations) typically covers forms of non-transitory tangible media and transitory propagating signals per se in view of the ordinary and customary meaning of computer readable media, particularly when

> the specification is silent. See MPEP 2111.01. When the broadest reasonable interpretation of a claim covers a signal per se, the claim must be rejected under 35 U.S.C. § 101 as covering non-statutory subject matter. See In re Nuijten, 500 F.3d 1346, 1356-57 (Fed. Cir. 2007) (transitory embodiments are not directed to statutory subject matter) and Interim Examination Instructions for Evaluating Subject Matter Eligibility Under 35 U.S.C. § 101, Aug. 24, 2009; p.2.
>
> The USPTO recognizes that applicants may have claims directed to computer readable media that cover signals per se, which the USPTO must reject under 35 U.S.C. § 101 as covering both non-statutory subject matter and statutory subject matter. In an effort to assist the patent community in overcoming a rejection or potential rejection under 35 U.S.C. § 101 in this situation, the USPTO suggests the following approach. A claim drawn to such a computer readable medium that covers both transitory and non-transitory embodiments may be amended to narrow the claim to cover only statutory embodiments to avoid a rejection under 35 U.S.C. § 101 by adding the limitation "non-transitory" to the claim. Cf. Animals - Patentability,1077 Off. Gaz. Pat. Office 24 (April 21, 1987) (suggesting that applicants add the limitation "non-human" to a claim covering a multi-cellular organism to avoid a rejection under 35 U.S.C. § 101). Such an amendment would typically not raise the issue of new matter, even when the specification is silent because the broadest reasonable interpretation relies on the ordinary and customary meaning that includes signals per se. The limited situations in which such an amendment could raise issues of new matter occur, for example, when the specification does not support a non-transitory embodiment because a signal per se is the only viable embodiment such that the amended claim is impermissibly broadened beyond the supporting disclosure. See, e.g., Gentry Gallery, Inc. v. Berkline Corp., 134 F.3d 1473 (Fed. Cir. 1998).

6. Claims 16-20 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter as follows. Claims 16-20 recite a computer readable medium, which typically covers both forms of non-transitory tangible medium and transitory propagating signals *per se* under the broadest reasonable interpretation of the claim. Moreover, the specification does not define or disclose the details of the computer readable medium, which means that the computer readable medium can **cover forms of carrier waves and transitory propagating signals** under the broadest reasonable claim interpretation [emphasis added]. A claim drawn to such a computer readable medium that covers both transitory and non-transitory embodiments may be amended to narrow the claim to cover only statutory embodiments to avoid a rejection under 35 U.S.C. § 101 by adding the limitation **non-transitory** to the claim [emphasis added].

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1-2, 4, 6, 30, 32, 34 and 36-39 are rejected under 35 U.S.C. 102(b) as being anticipated by Michael et al. (US 5,768,443).

a. Regarding claim 1, Michael discloses a method of fitting acquired fiducial data to a set of fiducials (FIGs. 6 and 9, "The inventor discloses a method of image distortion correction and local-to-global coordinate transformation using pixel and landmark" at col. 16, lines 4-12) on a fiducial plate ("semiconductor wafer" at col. 16, line 53) said method comprising:

fitting a fiducial grid model to data (FIG. 6-48, "estimate camera distortion correction for each camera"; equations (1)-(5) and (13)-(39); "The inventor discloses fitting (computing) a function- $x = G_x(u,v) = \sum_{i,j\geq 0}^{i+j\leq n} a_{ij} u^i v^i$ and $y = G_y(u,v) = \sum_{i,j\geq 0}^{i+j\leq n} b_{ij} u^i v^i$, to a set of data for the correction map." at col. 7, line 40 to col. 8, line 25 and col. 12, lines 22 to col. 15, line 40) acquired by an imaging apparatus (FIG. 1-18, 20 or 22; col. 7, lines 41, "particular camera") captured such that features are positioned in space relative to the fiducial plate (FIG. 6-48, "estimate camera distortion correction for each camera"; equations (1)-(5) and (13)-(39); "The inventor discloses fitting (computing) a

function- $x = G_x(u,v) = \sum_{i,j\geq 0}^{i+j\leq n} a_{ij} u^i v^i$ and $y = G_y(u,v) = \sum_{i,j\geq 0}^{i+j\leq n} b_{ij} u^i v^i$ that can a point of a observed coordinate or image coordinate {u,v} can be transform to a model coordinate or a physical space {x,y} at col. 7, line 40 to col. 8, line 25 and col. 12, lines 22 to col. 15, line 40);

establishing a conversion (FIG. 6-50; “The inventor discloses estimating the transformation from distortion-corrected camera coordinates or corrected local physical coordinates to global physical coordinates or global coordinates” at col. 7, lines 10-39 and col. 15, line 53 to col. 16, line 39) from acquired coordinates (“distortion-corrected camera coordinates or corrected local physical coordinates” at col. 7, lines 10-39 and col. 15, line 53 to col. 16, line 39) to ideal fiducial coordinates (“global physical coordinates or global coordinates” at col. 7, lines 10-39 and col. 15, line 53 to col. 16, line 39) using a data processing component (The MPEP teaches that [t]he express, implicit, and ***inherent*** disclosures of a prior art reference may be relied upon in ***the rejection of claims under 35 U.S.C. 102*** or 103[1] [emphasis added]. So, “it is inherent that some sort of data processing component will be used for the estimation of transformation from distortion-corrected camera coordinates or corrected local physical coordinates to global physical coordinates or global coordinates because it uses coordinates of a point or a pixel” at col. 7, lines 10-39 and col. 15, line 53 to col. 16, line 39);

calculating an absolute location for each identified acquired image feature centers (“pixels associated with feature points” at col. 16, lines 57-58) relative to the

fiducial plate in fiducial plate coordinates (FIG. 9-56, “The inventor discloses that all of the pixels or the pixels associated with feature points are corrected for camera distortion using distortion correction map. The distortion correction map has a fitting function, $x = G_x(u,v) = \sum_{i,j\geq 0}^{i+j\leq n} a_{ij} u^i v^i$ and $y = G_y(u,v) = \sum_{i,j\geq 0}^{i+j\leq n} b_{ij} u^i v^i$ that can a point of an observed coordinate or an image coordinate {u,v} can be transformed to a model coordinate or a physical space {x,y}, which is a transformation or a calculation of a point or a pixel in one coordinate to the other one. Moreover, it well known that a coordinate or a coordinate system does tell the location of a pixel or a point from the center of the coordinate or coordinate system.” at col. 7, line 40 to col. 8, line 25, col. 12, lines 22 to col. 15, line 40 and col. 16, lines 54-58) using the data processing component (The MPEP teaches that [t]he express, implicit, and ***inherent*** disclosures of a prior art reference may be relied upon in ***the rejection of claims under 35 U.S.C. 102*** or 103[2] [emphasis added]. So, “it is inherent that some sort of data processing component will be used for the camera corrected distortion using a distortion correction map because it uses coordinates of a pixel” at col. 7, line 40 to col. 8, line 25, col. 12, lines 22 to col. 15, line 40 and col. 16, lines 54-58) the absolute location indicating a distance measurement in fiducial plate coordinates (“It well known that a coordinate or a coordinate system does indicate the location of a pixel or a point from the center of the coordinate or coordinate system, which is an indication of the distance from the center”

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[1] See MPEP § 2112
[2] See MPEP § 2112

at col. 7, line 40 to col. 8, line 25, col. 12, lines 22 to col. 15, line 40 and col. 16, lines 54-58); and

based on at least one calculated absolute location of the identified acquired image feature centers (col. 16, lines 57-58, “pixels associated with feature points”), selectively modifying a structure represented by the identified acquired image feature center (“It is disclosed that only pixels associated with feature points of interest are corrected” at col. 16, lines 57-58).

b. Regarding claim 2, Michael discloses wherein said fitting (FIG. 6-48, “estimate camera distortion correction for each camera”; equations (1)-(5) and (13)-(39); “The inventor discloses fitting (computing) a function- $x = G_x(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} a_{ij} u^i v^i$ and $y = G_y(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} b_{ij} u^i v^i$, to a set of data for the correction map.” at col. 7, line 40 to col. 8, line 25 and col. 12, lines 22 to col. 15, line 40) comprises identifying fiducial coordinates for each fiducial captured in said data (“[T]he landmark feature of the calibration target is used to establish a local origin for the corrected physical coordinate system” at col. 7, lines 14-16) acquired by said imaging apparatus (FIG. 1-18, 20 or 22; col. 7, lines 41, “particular camera”).

c. Regarding claim 4, Michael discloses wherein said calculating (FIG. 9-56, “The inventor discloses that all of the pixels or the pixels associated with feature points are corrected for camera distortion using distortion correction map. The distortion correction map has a fitting function, $x = G_x(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} a_{ij} u^i v^i$ and

$y = G_y(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} b_{ij} u^i v^i$ that can a point of an observed coordinate or an image coordinate {u,v} can be transformed to a model coordinate or a physical space {x,y}, which is a transformation or a calculation of a point or a pixel in one coordinate to the other one. Moreover, it well known that a coordinate or a coordinate system does tell the location of a pixel or a point from the center of the coordinate or coordinate system." at col. 7, line 40 to col. 8, line 25, col. 12, lines 22 to col. 15, line 40 and col. 16, lines 54-58) comprises utilizing a linear least squares operation (equations (18)-(22); "Singular Value Decomposition technique to solve least-squares problems … Ax=b" at col. 12, line 61 to col. 13, line 27).

d. Regarding claim 6, Michael discloses wherein said imaging apparatus comprising a charge- coupled device camera ("image device [] such as a CCD (charge coupled device)" at col. 6, lines 40-41).

e. Regarding claim 29, Michael discloses a method of accurately identifying a location of a feature relative to a fiducial plate comprising:

acquiring an image of an object with an imaging apparatus (FIG. 1-18, 20 or 22; col. 7, lines 41, "particular camera"), the image comprising data concerning the position of a plurality of fiducial marks on a fiducial plate and data concerning the position of a feature of the object, the image being acquired such that the data concerning the position of a plurality of fiducial marks on a fiducial plate and data concerning the position of a feature of the object is obtained simultaneously (FIG. 6-48, "estimate camera distortion correction for each camera"; equations (1)-(5) and (13)-(39); "The

inventor discloses fitting (computing) a function- $x = G_x(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} a_{ij} u^i v^i$ and

$y = G_y(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} b_{ij} u^i v^i$ that can a point of a observed coordinate or image coordinate {u,v} can be transform to a model coordinate or a physical space {x,y} at col. 7, line 40 to col. 8, line 25 and col. 12, lines 22 to col. 15, line 40);

fitting a fiducial grid model to the image data to establish a conversion from coordinates of the plurality of fiducial marks acquired from the image to coordinates of the plurality of fiducial marks on the fiducial plate using a data processing component (FIG. 6-48, “estimate camera distortion correction for each camera”; equations (1)-(5) and (13)-(39); “The inventor discloses fitting (computing) a function-

$x = G_x(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} a_{ij} u^i v^i$ and $y = G_y(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} b_{ij} u^i v^i$ that can a point of a observed coordinate or image coordinate {u,v} can be transform to a model coordinate or a physical space {x,y} at col. 7, line 40 to col. 8, line 25 and col. 12, lines 22 to col. 15, line 40);

calculating an absolute location of a center of each of the plurality of fiducial marks in the acquired image relative to the fiducial plate in fiducial plate coordinates using the data processing component, the absolute location indicating a distance measurement in fiducial plate coordinates (FIG. 9-56, “The inventor discloses that all of the pixels or the pixels associated with feature points are corrected for camera distortion using distortion correction map. The distortion correction map has a fitting function,

$x = G_x(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} a_{ij} u^i v^i$ and $y = G_y(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} b_{ij} u^i v^i$ that can a point of an observed coordinate or an image coordinate {u,v} can be transformed to a model coordinate or a physical space {x,y}, which is a transformation or a calculation of a point or a pixel in one coordinate to the other one. Moreover, it well known that a coordinate or a coordinate system does tell the location of a pixel or a point from the center of the coordinate or coordinate system." at col. 7, line 40 to col. 8, line 25, col. 12, lines 22 to col. 15, line 40 and col. 16, lines 54-58); and,

determining a position of a feature of the object in the acquired image and modifying the determined position based on at least one calculated absolute location of the plurality of fiducial marks in the acquired image (FIG. 9-56, "The inventor discloses that all of the pixels or the pixels associated with feature points are corrected for camera distortion using distortion correction map. The distortion correction map has a fitting function, $x = G_x(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} a_{ij} u^i v^i$ and $y = G_y(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} b_{ij} u^i v^i$ that can a point of an observed coordinate or an image coordinate {u,v} can be transformed to a model coordinate or a physical space {x,y}, which is a transformation or a calculation of a point or a pixel in one coordinate to the other one. Moreover, it well known that a coordinate or a coordinate system does tell the location of a pixel or a point from the center of the coordinate or coordinate system." at col. 7, line 40 to col. 8, line 25, col. 12, lines 22 to col. 15, line 40 and col. 16, lines 54-58).

f. Regarding claim 30, claim 30 is analogous and corresponds to claim 2. See rejection of claim 2 for further explanation.

g. Regarding claim 32, claim 32 is analogous and corresponds to claim 4. See rejection of claim 4 for further explanation.

h. Regarding claim 34, claim 34 is analogous and corresponds to claim 6. See rejection of claim 6 for further explanation.

i. Regarding claim 36, Michael discloses wherein the object is part of a semiconductor probe card (“semiconductor wafer” at col. 16, line 53).

j. Regarding claim 37, claim 37 is analogous and corresponds to claim 29. See rejection of claim 29 for further explanation.

k. Regarding claim 38, Michael discloses further comprising: interposing a substantially transparent substrate having a plurality of fiducials formed therein between the imaging apparatus and the object (“semiconductor wafer” at col. 16, line 53).

l. Regarding claim 39, Michael discloses further comprising: acquiring a succession of images with an imaging apparatus, each of the succession of images including both the object and the plurality of fiducial marks (FIGs. 6 and 9, “The inventor discloses a method of image distortion correction and local-to-global coordinate transformation using pixel and landmark” at col. 16, lines 4-12).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claim 3, 16-19 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Michael et al. (US 5,768,443) in view of Thompson (US 5,020,123).

a. Regarding claim 3, Michael discloses all the previous claim limitations including said identifying coordinates for each fiducial ("[T]he landmark feature of the calibration target is used to establish a local origin for the corrected physical coordinate system" at col. 7, lines 14-16) and said calculating an absolute location (FIG. 9-56, "The inventor discloses that all of the pixels or the pixels associated with feature points are corrected for camera distortion using distortion correction map. The distortion correction map has a fitting function, $x = G_x(u,v) = \sum_{i,j\geq 0}^{i+j\leq n} a_{ij} u^i v^i$ and $y = G_y(u,v) = \sum_{i,j\geq 0}^{i+j\leq n} b_{ij} u^i v^i$ that can a point of an observed coordinate or an image coordinate {u,v} can be transformed to a model coordinate or a physical space {x,y}, which is a transformation or a calculation of a point or a pixel in one coordinate to the other one. Moreover, it well known that a coordinate or a coordinate system does tell the location of a pixel or a point from the center of the coordinate or coordinate system" at col. 7, line 40 to col. 8, line 25, col. 12, lines 22 to col. 15, line 40 and col. 16, lines 54-58) of identified acquired image feature centers ("pixels associated with feature points" at col. 16, lines 57-58).

However, Michael does not disclose a selectively iterating process.

Instead of Michael, Thompson, the same field of endeavor of detecting image distortion, discloses selectively iterating process (FIGs. 2-205, 2-206, 2-207, "The

invention shows an iterating process that fiducial marking are identified or compared with a predetermined tolerance" at col. 3, line 53 to col. 3, line 64).

Michael and Thompson are combinable because both of them are related to the field of image distortion.

Michael **contains a "base" process of** identifying coordinates for each fiducial as **"the landmark feature of the calibration target being used to establish a local origin for the corrected physical coordinate system"** (Michael; col. 7, lines 14-16) and calculating an absolute location as the step of **"all of the pixels or the pixels associated with feature points are corrected for camera distortion using distortion correction map comprising a fitting function,** $x = G_x(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} a_{ij} u^i v^i$ **and** $y = G_y(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} b_{ij} u^i v^i$ **that can a point of an observed coordinate or an image coordinate {u,v} can be transformed to a model coordinate or a physical space {x,y}, which is a transformation or a calculation of a point or a pixel in one coordinate to the other one** (Michael; col. 7, line 40 to col. 8, line 25, col. 12, lines 22 to col. 15, line 40 and col. 16, lines 54-58) of identified acquired image feature centers corresponding to the "**pixels associated with feature points"** (Michael; col. 16, lines 57-58), **which the claimed invention can be seen as an "improvement"** in that **selectively iterating the process of the indentifying coordinates of fiducial and calculating the absolute location of the image feature centers** [emphasis added].

Thompson **contains a known technique** of selectively iterating process corresponding to the **"iterating process that fiducial marking are identified or**

compared with a predetermined tolerance" (Thompson; FIGs. 2-205, 2-206, 2-207; col. 3, line 53 to col. 3, line 64) [emphasis added].

One of ordinary skilled in the art would have been recognized that applying Thompson's **known technique** of the selectively iterating process (Thompson; FIGs. 2-205, 2-206, 2-207, "The invention shows an iterating process that fiducial marking are identified or compared with a predetermined tolerance" at col. 3, line 53 to col. 3, line 64) **as applicable to the "base" process** of Michael, which comprises identifying coordinates for each fiducial (Michael; "[T]he landmark feature of the calibration target is used to establish a local origin for the corrected physical coordinate system" at col. 7, lines 14-16) and calculating an absolute location (Michael; FIG. 9-56, "The inventor discloses that all of the pixels or the pixels associated with feature points are corrected for camera distortion using distortion correction map. The distortion correction map has a fitting function, $x = G_x(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} a_{ij} u^i v^i$ and $y = G_y(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} b_{ij} u^i v^i$ that can a point of an observed coordinate or an image coordinate {u,v} can be transformed to a model coordinate or a physical space {x,y}, which is a transformation or a calculation of a point or a pixel in one coordinate to the other one" at col. 7, line 40 to col. 8, line 25, col. 12, lines 22 to col. 15, line 40 and col. 16, lines 54-58) of identified acquired image feature centers (Michael;"pixels associated with feature points" at col. 16, lines 57-58) **would have yielded predictable results of selectively iterating process for identifying the coordinates of each fiducial and calculating the absolute location of the image feature center**, which **results in an improved process such** as "[providing] [a] robust handling of distortion and noise" (Thompson; col. 6, lines 56-57), "area identification

…accurately performed with any number of fiducial markings … [and] realized even in situations in which fiducial markings are missing or are unrecognizable” (Thompson; col. 6, lines 59-63) [emphasis added].

Therefore, it would have been obvious to combine Michael and Thompson to obtain the invention specified in claim 3.

b. Regarding claim 16, claim 16 recites a computer readable medium encoded with data and instructions, said data and said instruction causing an apparatus executing said instructions comprising steps equivalent to claims 1.

Michael discloses fitting acquired fiducial data to a set of fiducials (FIGs. 6 and 9, “The inventor discloses a method of image distortion correction and local-to-global coordinate transformation using pixel and landmark” at col. 16, lines 4-12) on a fiducial plate (“semiconductor wafer” at col. 16, line 53);

fit a fiducial grid model to data (FIG. 6-48, “estimate camera distortion correction for each camera”; equations (1)-(5) and (13)-(39); “The inventor discloses fitting (computing) a function- $x = G_x(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} a_{ij} u^i v^i$ and $y = G_y(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} b_{ij} u^i v^i$, to a set of data for the correction map.” at col. 7, line 40 to col. 8, line 25 and col. 12, lines 22 to col. 15, line 40) acquired by an imaging apparatus (FIG. 1-18, 20 or 22; col. 7, lines 41, “particular camera”) captured such that features are positioned in space relative to the fiducial plate (FIG. 6-48, “estimate camera distortion correction for each camera”; equations (1)-(5) and (13)-(39); “The inventor discloses fitting (computing) a function- $x = G_x(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} a_{ij} u^i v^i$ and $y = G_y(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} b_{ij} u^i v^i$ that can a point of a observed

coordinate or image coordinate {u,v} can be transform to a model coordinate or a physical space {x,y} at col. 7, line 40 to col. 8, line 25 and col. 12, lines 22 to col. 15, line 40);

establish a conversion (FIG. 6-50; "The inventor discloses estimating the transformation from distortion-corrected camera coordinates or corrected local physical coordinates to global physical coordinates or global coordinates" at col. 7, lines 10-39 and col. 15, line 53 to col. 16, line 39) from acquired coordinates of each identified fiducial ("distortion-corrected camera coordinates or corrected local physical coordinates" at col. 7, lines 10-39 and col. 15, line 53 to col. 16, line 39) to ideal plate coordinates ("global physical coordinates or global coordinates" at col. 7, lines 10-39 and col. 15, line 53 to col. 16, line 39); and

calculating an absolute location for each identified acquired image feature centers (col. 16, lines 57-58, "pixels associated with feature points") relative to the fiducial plate (FIG. 9-56, "The inventor discloses that all of the pixels or the pixels associated with feature points are corrected for camera distortion using distortion correction map. The distortion correction map has a fitting function,

$x = G_x(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} a_{ij} u^i v^i$ and $y = G_y(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} b_{ij} u^i v^i$ that can a point of an observed coordinate or an image coordinate {u,v} can be transformed to a model coordinate or a physical space {x,y}, which is a transformation or a calculation of a point or a pixel in one coordinate to the other one. Moreover, it well known that a coordinate or a coordinate system does tell the location of a pixel or a point from the center of the coordinate or coordinate system." at col. 7, line 40 to col. 8, line 25, col. 12, lines 22 to

col. 15, line 40 and col. 16, lines 54-58), the absolute location indicating a distance measurement in fiducial plate coordinates (“It well known that a coordinate or a coordinate system does tell the location of a pixel or a point from the center of the coordinate or coordinate system, which an indicate the distance from the center” at col. 7, line 40 to col. 8, line 25, col. 12, lines 22 to col. 15, line 40 and col. 16, lines 54-58).

However, Michael does not discloses a computer readable medium encoded with data and instructions, said data and said instruction causing an apparatus executing said instructions.

Instead of Michael, Thompson, the same field of endeavor of detecting image distortion, discloses a computer readable medium (FIG. 1-103; "disk storage unit" at col. 2, line 44) encoded with data and instructions (FIGS. 1-102 and 103; “processing unit” and “memory” at col. 2, lines 43-44), said data and said instruction causing an apparatus executing said instructions (FIG. 1-101, “computer [being] AT&T 6386 Work Group System (WGS)” at col. 2, lines 42-43).

Michael and Thompson are combinable because both of them are related to detecting image distortion.

At the time of the invention, it would have obvious to a person of ordinary skill in the art to use the “AT&T 6386 Work Group System (WGS)" (FIG. 1-101; col. 2, lines 42-43) comprising “memory" (Thompson; FIG. 1-103; col. 2, line 43-44), "processing unit (Thompson; FIG. 1-120; col. 2, line 43) and a “disk storage unit (DISK)” (Thompson; FIG. 1-104; col. 2, line 44) of Thompson to run the steps of “estimate[ing] camera distortion correction for each camera” (Michael; FIG. 6-48) using fitting (computing) a

function- $x = G_x(u,v) = \sum_{i,j\geq 0}^{i+j\leq n} a_{ij}u^i v^i$ and $y = G_y(u,v) = \sum_{i,j\geq 0}^{i+j\leq n} b_{ij}u^i v^i$, to a set of data for the correction map" (Michael; equations (1)-(5) and (13)-(39); col. 7, line 40 to col. 8, line 25 and col. 12, lines 22 to col. 15, line 40), estimating the transformation from distortion-corrected camera coordinates or corrected local physical coordinates to global physical coordinates or global coordinates (Michael; FIG. 6-50; col. 7, lines 10-39 and col. 15, line 53 to col. 16, line 39), and pixels or pixels associated with feature points being corrected for camera distortion using distortion correction map that has a fitting function, $x = G_x(u,v) = \sum_{i,j\geq 0}^{i+j\leq n} a_{ij}u^i v^i$ and $y = G_y(u,v) = \sum_{i,j\geq 0}^{i+j\leq n} b_{ij}u^i v^i$ that can a point of an observed coordinate or an image coordinate {u,v} can be transformed to a model coordinate or a physical space {x,y}, which is a transformation or a calculation of a point or a pixel in one coordinate to the other one (Michael; col. 7, line 40 to col. 8, line 25, col. 12, lines 22 to col. 15, line 40 and col. 16, lines 54-58) taught by Michael.

The suggestion/motivation for doing so would have yielded the predictable results of correcting image distortion, with no change in the original principle or functionality of the processing system, and thereby resulting in an improved process by adding benefits such as a higher computation speed and a more efficient computation.

Therefore, it would have been obvious to combine Michael and Thompson to obtain the invention recited in claim 16.

c. Regarding claim 17, Claims 17 recites a computer readable medium encoded with data and instructions, said data and said instruction causing an apparatus executing said instructions comprising steps equivalent to claims 2.

Thompson discloses a computer readable medium (FIG. 1-103; "disk storage unit" at col. 2, line 44) encoded with data and instructions (FIGS. 1-102 and 103; “processing unit” and “memory” at col. 2, lines 43-44), said data and said instruction causing an apparatus executing said instructions (FIG. 1-101, “computer [being] AT&T 6386 Work Group System (WGS)” at col. 2, lines 42-43).

Rest of the claim limitations are analogous and correspond to claim 2. See rejection of claim 2 for further explanation.

d. Regarding claim 18, Claims 18 recites a computer readable medium encoded with data and instructions, said data and said instruction causing an apparatus executing said instructions comprising steps equivalent to claims 3.

Thompson discloses a computer readable medium (FIG. 1-103; "disk storage unit" at col. 2, line 44) encoded with data and instructions (FIGS. 1-102 and 103; “processing unit” and “memory” at col. 2, lines 43-44), said data and said instruction causing an apparatus executing said instructions (FIG. 1-101, “computer [being] AT&T 6386 Work Group System (WGS)” at col. 2, lines 42-43).

Rest of the claim limitations are analogous and correspond to claim 3. See rejection of claim 3 for further explanation.

e. Regarding claim 19, Claims 19 recites a computer readable medium encoded with data and instructions, said data and said instruction causing an apparatus executing said instructions comprising steps equivalent to claims 4.

Thompson discloses a computer readable medium (FIG. 1-103; "disk storage unit" at col. 2, line 44) encoded with data and instructions (FIGS. 1-102 and 103;

"processing unit" and "memory" at col. 2, lines 43-44), said data and said instruction causing an apparatus executing said instructions (FIG. 1-101, "computer [being] AT&T 6386 Work Group System (WGS)" at col. 2, lines 42-43).

Rest of the claim limitations are analogous and correspond to claim 4. See rejection of claim 4 for further explanation.

f. Regarding claim 31, claim 31 is analogous and corresponds to claim 3. See rejection of claim 3 for further explanation.

10. Claims 5 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Michael et al. (US 5,768,443) in view of Macy et al. (US 6,538,691).

a. Regarding claim 5, Michael discloses all the previous claim limitations including assuming that a rotation of said imaging apparatus (FIG. 1-18, 20 or 22; col. 7, lines 41, "particular camera") relative is negligible (FIG. 6-48, "estimate camera distortion correction for each camera"; equations (1)-(5) and (13)-(39); "The inventor discloses fitting (computing) a function- $x = G_x(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} a_{ij} u^i v^i$ and $y = G_y(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} b_{ij} u^i v^i$, to a set of data for the distortion correction map, which point of an observed coordinate or an image coordinate {u,v} can be transformed to a model coordinate or a physical space {x,y} without considering the rotation of the camera relative to the coordinate " at col. 7, line 40 to col. 8, line 25 and col. 12, lines 22 to col. 15, line 40).

However, Michael does not disclose the fiducial grid.

Instead of Michael, Macy, the same field of endeavor of correction of image distortion, discloses the fiducial grid (FIGs. 1, 3 and 5; “camera grid (CG)” at col. 3, lines 27-28).

Michael and Macy are combinable because both of them are related to the field of image distortion correction.

Michael **contains a “base” process** of assuming that a rotation of said imaging apparatus being negligible shown **as “fitting (computing) a function-**

$x = G_x(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} a_{ij} u^i v^i$ **and** $y = G_y(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} b_{ij} u^i v^i$ **, to a set of data for the distortion correction map, which point of an observed coordinate or an image coordinate {u,v} can be transformed to a model coordinate or a physical space {x,y} without considering the rotation of the camera relative to the coordinate”** (Michael; FIG. 6-48 equations (1)-(5) and (13)-(39); col. 7, line 40 to col. 8, line 25 and col. 12, lines 22 to col. 15, line 40), **which the claimed invention can be seen as an "improvement**” in that assuming a rotation of an imaging apparatus relative to a **fiducial grid** being negligible [emphasis added].

Macy **contains a known technique** of using a fiducial grid as **a computer grid** for displaying (Macy; FIGs. 1, 3 and 5; col. 3, lines 27-28) [emphasis added].

One of ordinary skilled in the art would have been recognized that applying Macy’s **known technique** of using a fiducial grid (Macy; FIGs. 1, 3 and 5; “camera grid (CG)” at col. 3, lines 27-28) for displaying **as applicable to the “base" process** (Michael; FIG. 6-48, “estimate camera distortion correction for each camera”; equations (1)-(5) and (13)-(39); “The inventor discloses fitting (computing) a function-

$x = G_x(u,v) = \sum_{i,j\geq 0}^{i+j\leq n} a_{ij}u^i v^i$ and $y = G_y(u,v) = \sum_{i,j\geq 0}^{i+j\leq n} b_{ij}u^i v^i$, to a set of data for the distortion correction map, which point of an observed coordinate or an image coordinate {u,v} can be transformed to a model coordinate or a physical space {x,y} without considering the rotation of the camera relative to the coordinate ” at col. 7, line 40 to col. 8, line 25 and col. 12, lines 22 to col. 15, line 40) of Michael **would have yielded predictable results** of assuming a rotation of an image apparatus relative to a fiducial grid being negligible for the correction of image distortion, which **results in an improved process such** as “[facilitating] the correction of digital image" (Macy; col. 3, lines 8)" and adding "greater computational efficiency without sacrificing accuracy” (Michael; col. 2, lines 50-51) [emphasis added].

Therefore, it would have been obvious to combine Michael and Macy to obtain the invention specified in claim 5.

b. Regarding claim 33, claim 33 is analogous and corresponds to claim 5. See rejection of claim 5 for further explanation.

11. Claims 7 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Michael et al. (US 5,768,443) in view of Leonard et al. (US 7,034,272 B1).

a. Regarding claim 7, Michael discloses all the previous claim limitation including imaging apparatus ("image device [] such as a CCD (charge coupled device)" at col. 6, lines 40-41).

However, Michael does not disclose said imaging device comprising a complementary metal-oxide semiconductor device.

Instead of Michael, Leonard, the same field of endeavor of calibration of the data measurements using coordinates, discloses said imaging device comprising a complementary metal-oxide semiconductor device (FIGs. 4-10 and 5-10; “CMOS camera” at col. 4, lines 45-49).

Michael and Leonard are combinable because both of them are related to the field of calibration of the data measurements using coordinates.

Michael contains an imaging device **which differed from the claimed device by the substitution of the CCD camera** (Micahel; col. 6, lines 40-41) **with complementary metal-oxide semiconductor device** [emphasis added]. Leonard discloses **substituted device as a CMOS camera** (FIGs. 4-10 and 5-10; “CMOS camera” at col. 4, lines 45-49), and **their functions were known in the art** to acquire an image of an object [emphasis added].

One of ordinary skilled in the art could have been substituted one known element for another, which is substituting the CMOS camera of Leonard (FIGs. 4-10 and 5-10; “CMOS camera” at col. 4, lines 45-49) **for the imaging device being a CCD camera** of Michael (col. 6, lines 40-41), and **the results of the substitution would have been predictable resulting in** acquiring image with less power or power consumption, the capability of accessing the region of interest of the image by integrating easily with other components as it is well-known [emphasis added].

Therefore, it would have been obvious to combine Michael and Leonard to obtain the invention specified in claim 7.

b. Regarding claim 35, claim 35 is analogous and corresponds to claim 7. See rejection of claim 7 for further explanation.

12. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Michael et al. (US 5,768,443) in view of Thompson (US 5,020,123) in view of Macy et al. (US 6,538,691).

a. Regarding claim 20, Claims 20 recites a computer readable medium encoded with data and instructions, said data and said instruction causing an apparatus executing said instructions comprising steps equivalent to claims 5.

The combination of Michael and Thompson, as applied in claim 16, discloses all the previous claim limitations including a computer readable medium (Thompson; FIG. 1-103; "disk storage unit" at col. 2, line 44) encoded with data and instructions (Thompson; FIGS. 1-102 and 103; “processing unit” and “memory” at col. 2, lines 43-44), said data and said instruction causing an apparatus executing said instructions (Thompson; FIG. 1-101, “computer [being] AT&T 6386 Work Group System (WGS)” at col. 2, lines 42-43) to assume that a rotation of said imaging apparatus (Michael; FIG. 1-18, 20 or 22; col. 7, lines 41, “particular camera”) relative is negligible (Michael; FIG. 6-48, “estimate camera distortion correction for each camera”; equations (1)-(5) and (13)-(39); “The inventor discloses fitting (computing) a function- $x = G_x(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} a_{ij} u^i v^i$ and $y = G_y(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} b_{ij} u^i v^i$, to a set of data for the distortion correction map, which point of an observed coordinate or an image coordinate {u,v} can be transformed to a model

coordinate or a physical space {x,y} without considering the rotation of the camera relative to the coordinate " at col. 7, line 40 to col. 8, line 25 and col. 12, lines 22 to col. 15, line 40).

However, the combination of Michael and Thompson does not disclose the fiducial grid.

Instead of the combination of Michael and Thompson, Macy, the same field of endeavor of detecting image distortion, discloses the fiducial grid (FIGs. 1, 3 and 5; “camera grid (CG)” at col. 3, lines 27-28).

Michael, Thompson and Macy are combinable because both of them are related to the field of detecting image distortion.

The combination of Michael and Thompson **contains a “base” product** of computer readable medium as an “AT&T 6386 Work Group System (WGS)" (FIG. 1-101; col. 2, lines 42-43) comprising “memory" (Thompson; FIG. 1-103; col. 2, line 43-44), "processing unit (Thompson; FIG. 1-120; col. 2, line 43) and a “disk storage unit (DISK)” (Thompson; FIG. 1-104; col. 2, line 44) having a step of assuming that a rotation of said imaging apparatus being negligible shown **as “fitting (computing) a function-** $x = G_x(u, v) = \sum_{i,j\geq 0}^{i+j\leq n} a_{ij} u^i v^i$ **and** $y = G_y(u, v) = \sum_{i,j\geq 0}^{i+j\leq n} b_{ij} u^i v^i$ **, to a set of data for the distortion correction map, which point of an observed coordinate or an image coordinate {u,v} can be transformed to a model coordinate or a physical space {x,y} without considering the rotation of the camera relative to the coordinate”** (Michael; FIG. 6-48 equations (1)-(5) and (13)-(39); col. 7, line 40 to col. 8, line 25 and col. 12, lines 22 to col. 15, line 40), **which the claimed invention can be seen as an**

"improvement" in that assuming a rotation of an imaging apparatus relative to a **fiducial grid** being negligible [emphasis added].

Macy **contains a known technique** of using a fiducial grid as **a computer grid** for displaying (Macy; FIGs. 1, 3 and 5; col. 3, lines 27-28) [emphasis added].

One of ordinary skilled in the art would have been recognized that applying Macy's **known technique** of using a fiducial grid (Macy; FIGs. 1, 3 and 5; "camera grid (CG)" at col. 3, lines 27-28) for displaying **as applicable to the "base" product** ("a computer readable medium (Thompson; FIG. 1-103; "disk storage unit" at col. 2, line 44) encoded with data and instructions (Thompson; FIGS. 1-102 and 103; "processing unit" and "memory" at col. 2, lines 43-44), said data and said instruction causing an apparatus executing said instructions (Thompson; FIG. 1-101, "computer [being] AT&T 6386 Work Group System (WGS)" at col. 2, lines 42-43) to assume that a rotation of said imaging apparatus (Michael; FIG. 1-18, 20 or 22; col. 7, lines 41, "particular camera") relative is negligible (Michael; FIG. 6-48, "estimate camera distortion correction for each camera"; equations (1)-(5) and (13)-(39); "The inventor discloses fitting (computing) a function- $x = G_x(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} a_{ij} u^i v^i$ and $y = G_y(u,v) = \sum_{i,j \geq 0}^{i+j \leq n} b_{ij} u^i v^i$, to a set of data for the distortion correction map, which point of an observed coordinate or an image coordinate {u,v} can be transformed to a model coordinate or a physical space {x,y} without considering the rotation of the camera relative to the coordinate " at col. 7, line 40 to col. 8, line 25 and col. 12, lines 22 to col. 15, line 40") of the combination of Michael and Thompson **would have yielded predictable results** of assuming a rotation of an image apparatus relative to a fiducial grid being negligible for the

correction of image distortion, which **results in an improved process such** as "[facilitating] the correction of digital image" (Macy; col. 3, lines 8)" and adding "greater computational efficiency without sacrificing accuracy" (Michael; col. 2, lines 50-51) [emphasis added].

Therefore, it would have been obvious to combine Michael, Thompson and Macy to obtain the invention specified in claim 20.

Conclusion

13. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

14. The prior art made of record is considered pertinent to the disclosure of the application:

- Smith et al. (US 4,467,211): An electron-beam array lithography (EBAL) system and method of operation is described. The method comprises deriving fiducial marking signals from a lenslet stitching grid of fiducial elements formed on a standard stitching target for calibrating the boundaries of the fields of view of the respective lens elements of an array of lenslets. The fiducial marking signals are used to stitch together the individual fields of view of the lens elements in the array of lenslets in order to cover a desired area of a workpiece surface to be subsequently exposed to the electron beam, for example, the surface of a semiconductor wafer upon which a plurality of integrated circuit chips are to be formed.
- Nonay et al. (US 6,618,494 B1): A system and method for digital x-ray imaging may correct distortion in a digital image by determining the cell size of a grid. A rotational correction may be applied to the cell to correct for distortion that might result from improper alignment between an imaging sensor used to capture the image and the image itself. Stretch factors for the pixels are calculated and applied to the cells of the grid to provide cells of consistent size. The calculated stretch factors may be applied to subsequent images to provide an efficient method for optical distortion correction.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOHN Wahnkyo LEE whose telephone number is

(571)272-9554. The examiner can normally be reached on Monday - Friday (Alt.) 7:30 a.m. - 5:00 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Samir Ahmed can be reached on (571) 272-7413. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/John Wahnkyo Lee/
Examiner, Art Unit 2624

/Brian Q Le/
Primary Examiner, Art Unit 2624